(12) UK Patent Application (19) GB (11) 2 333 253 (13) A

(43) Date of A Publication 21.07.1999

(21) Application No 9900608.2

(22) Date of Filing 12.01.1999

(30) Priority Data
(31) 19800999 (32) 14.01.1998 (33) DE
(31) 19829251 (32) 30.06.1998

(51) INT CL[6]
B23B 31/02 , B23Q 3/12

(52) UK CL (Edition Q)
B3B BHPX BMC1 B2G

(56) Documents Cited
GB 2152408 A US 5342154 A US 4968191 A

(58) Field of Search
UK CL (Edition Q) B3B
INT CL[6] B23B , B23Q

(71) Applicant(s)
Röhm GmbH
(Incorporated in the Federal Republic of Germany)
Heinrich-Röhm-Strasse 50, 89567 Sontheim,
Federal Republic of Germany

(72) Inventor(s)
Hans-Dieter Mack
Günter Horst Röhm

(74) Agent and/or Address for Service
Hughes Clark & Co
114-118 Southampton Row, LONDON, WC1B 5AA,
United Kingdom

(54) Abstract Title
Drilling apparatus

(57) In a drilling apparatus which comprises a drilling machine having a spindle and a drilling chuck. The latter has a chuck body in which a spindle receiving means is provided at its end towards the spindle and a tool receiving means is provided at the opposite end. The spindle is secured in its axial position with respect to the chuck body by a securing portion 30 and for the transmission of torque between the drilling chuck 2 and the spindle 1 has a non-rotationally symmetrical portion 4 which is nonrotatably coupled to a rotational receiving means provided on the chuck body. Various forms of securing portion and non-rotationally symmetrical portion are disclosed.

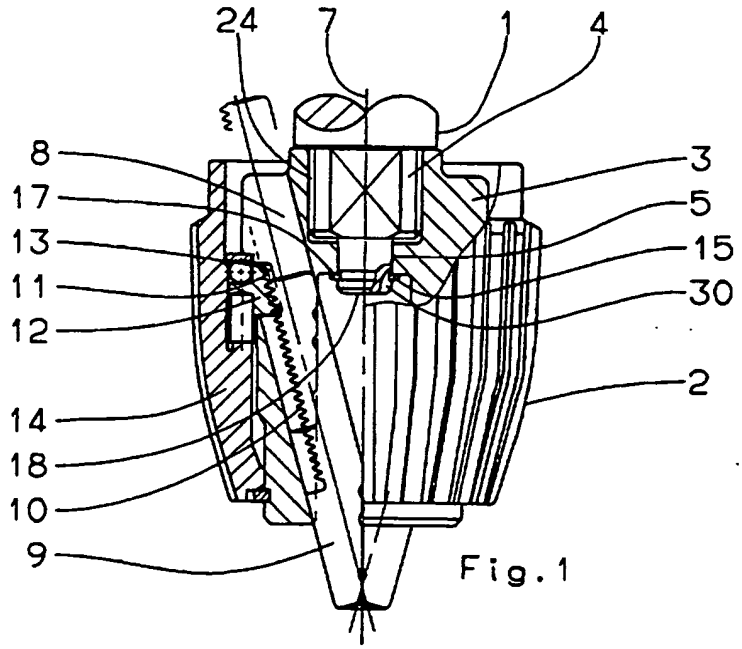

Fig.1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

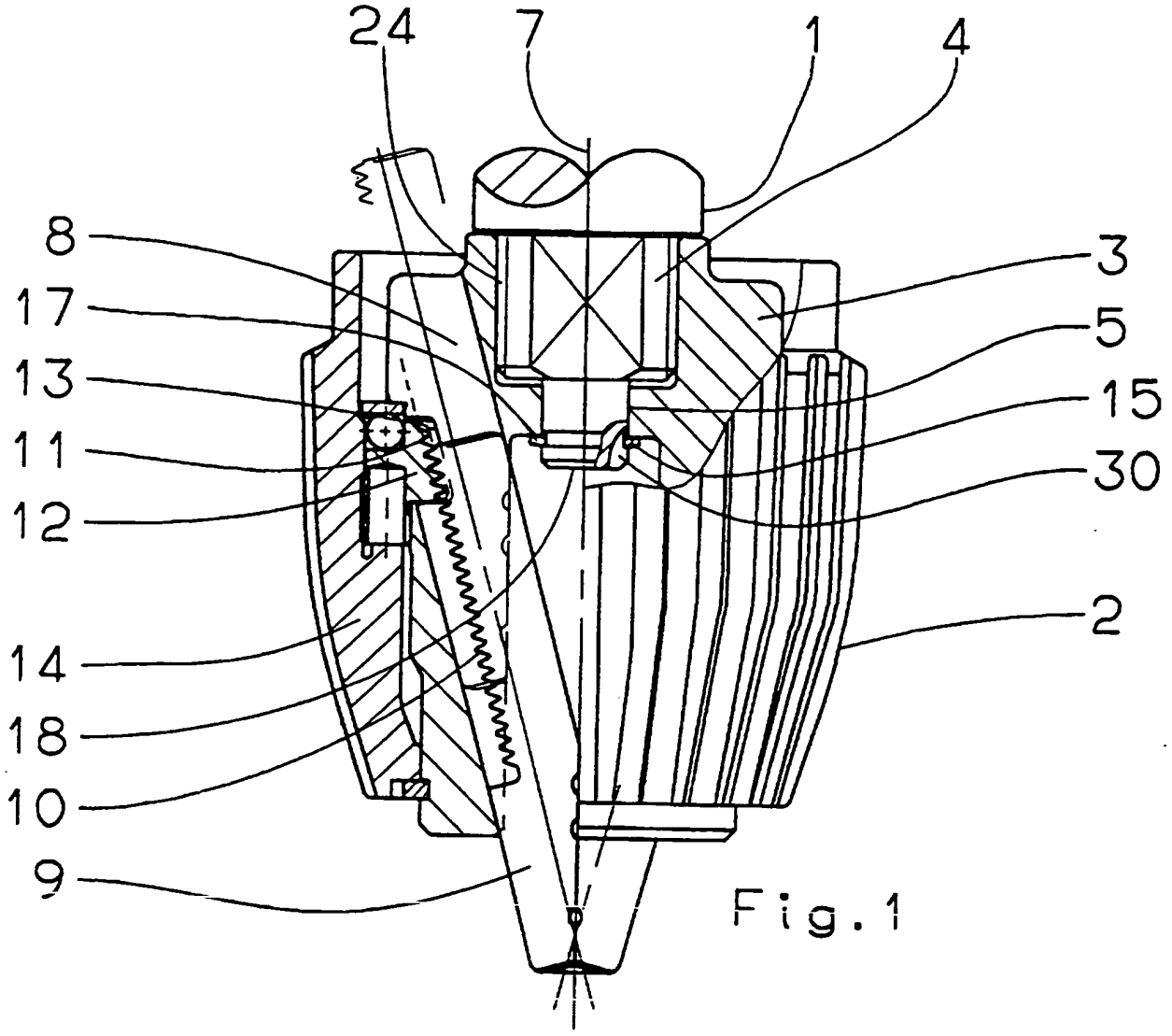


Fig.1

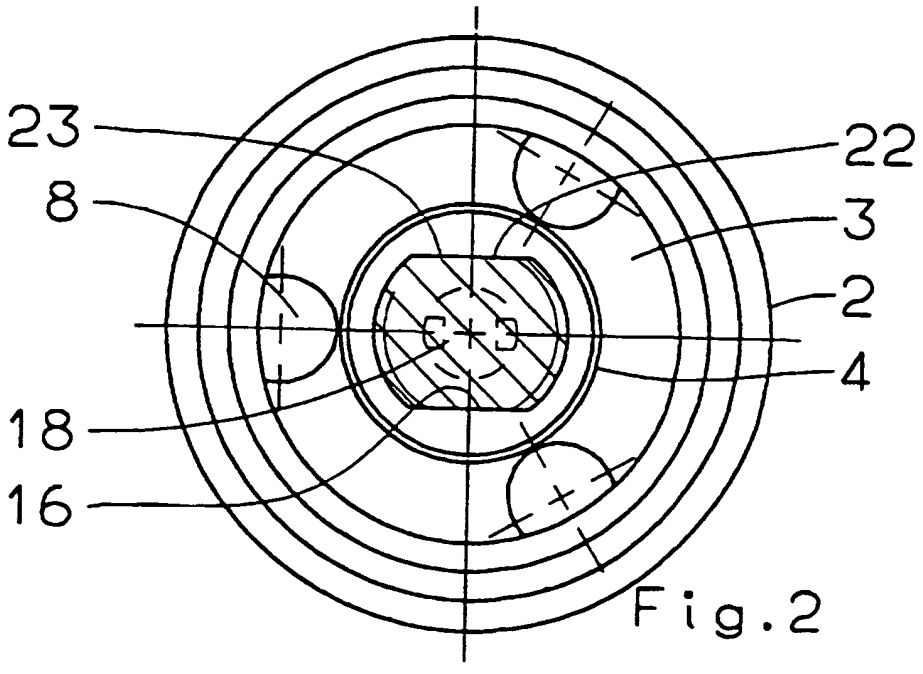


Fig.2

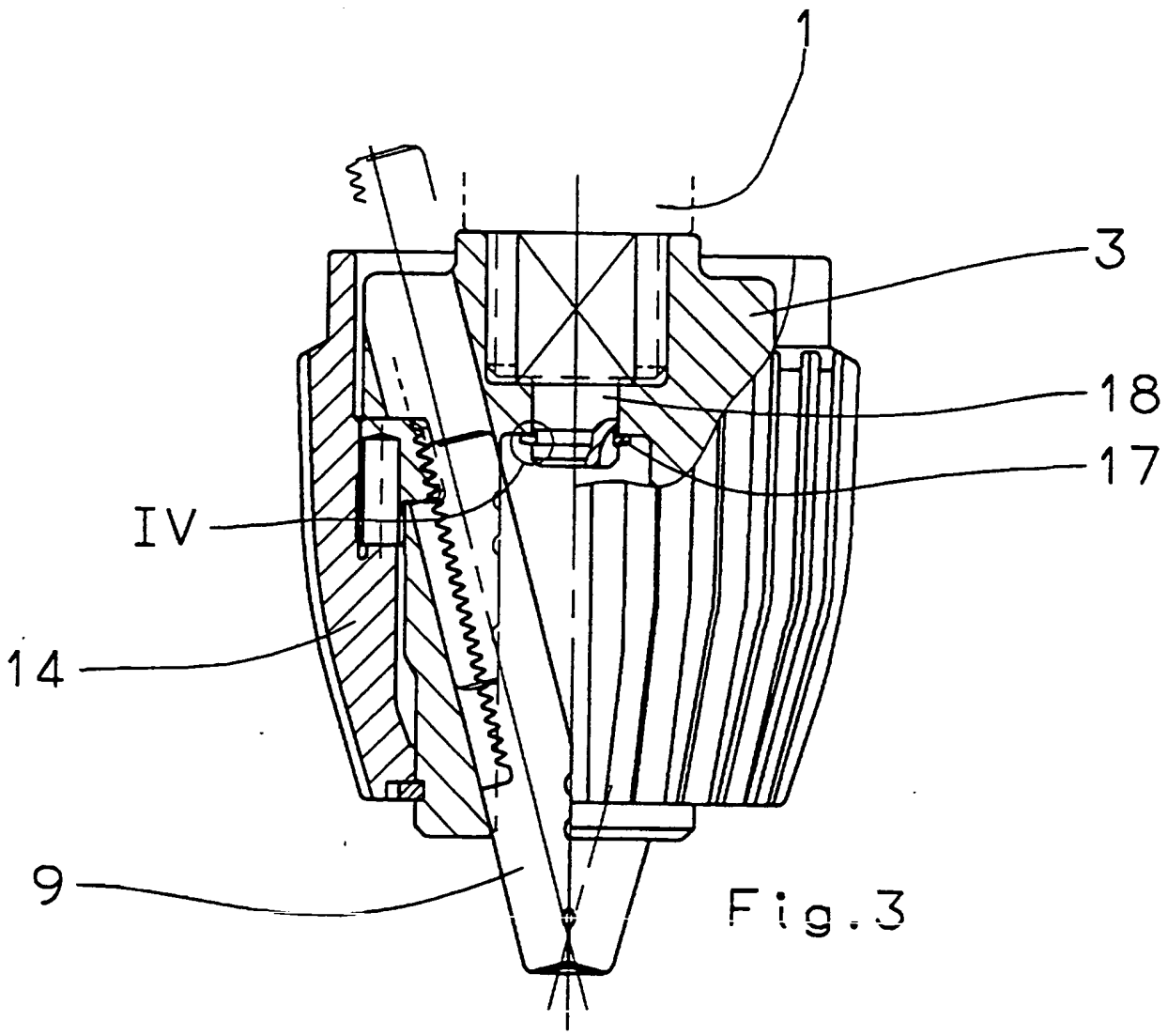


Fig.3

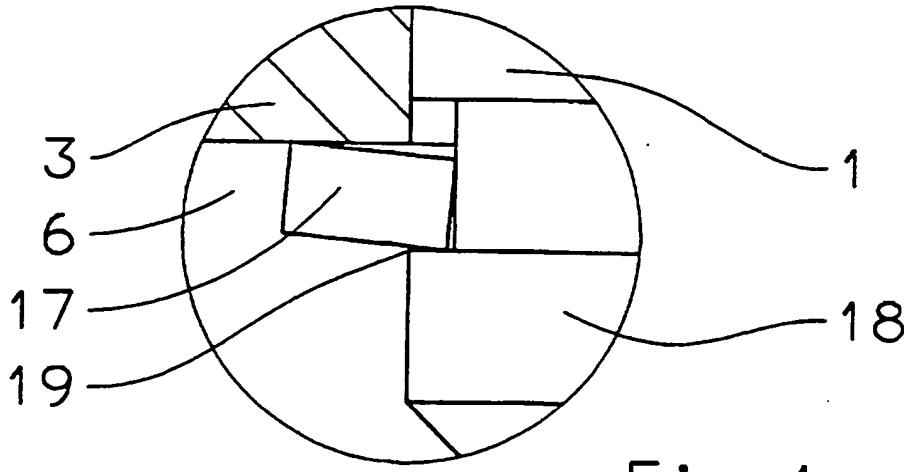


Fig.4

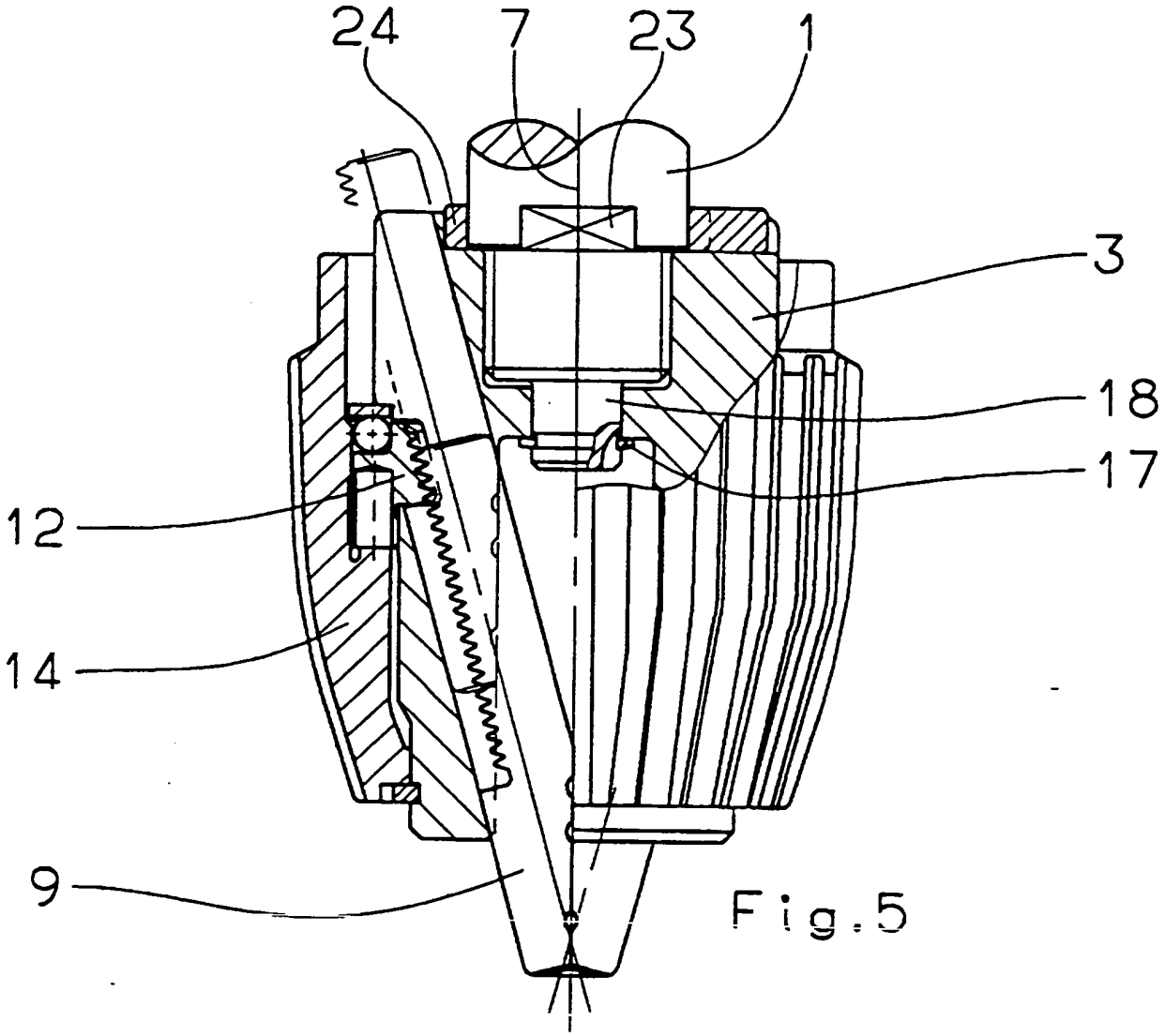
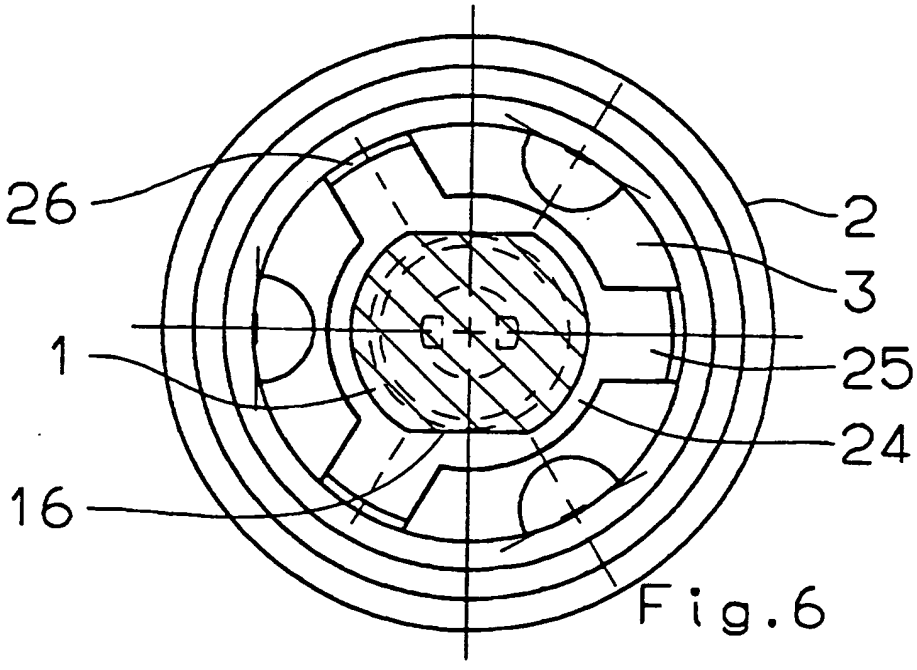


Fig.5



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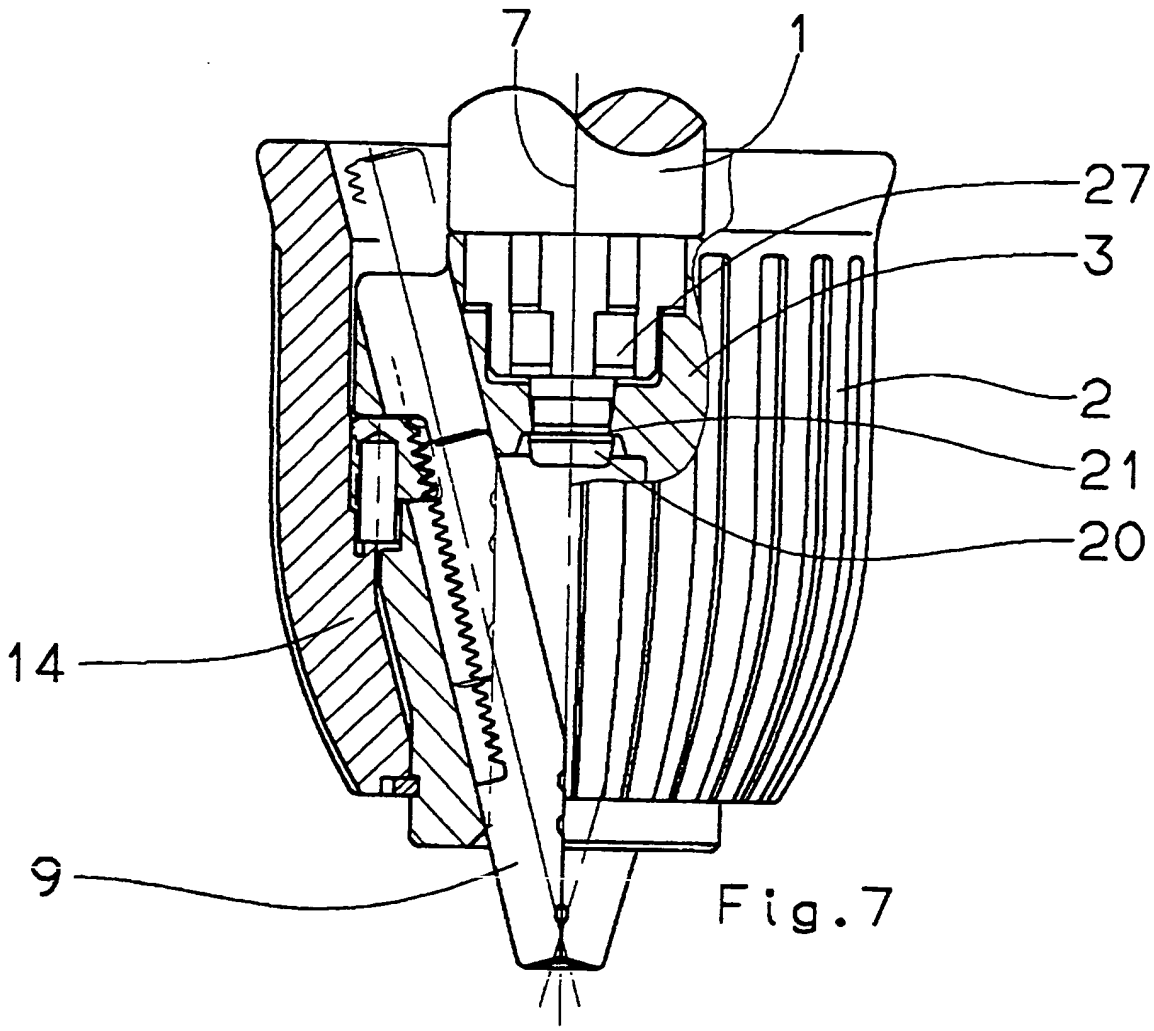


Fig.7

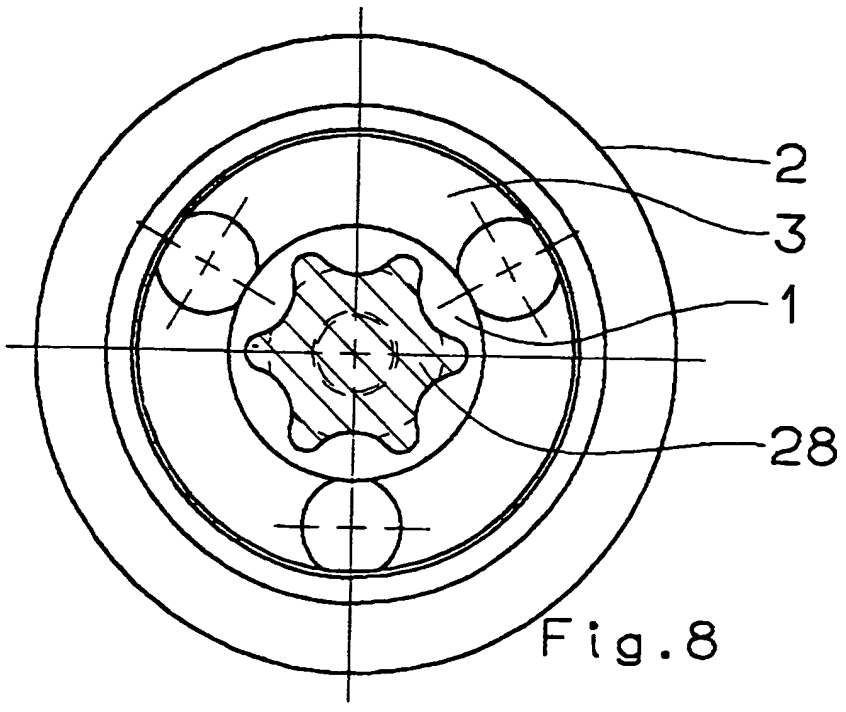


Fig.8

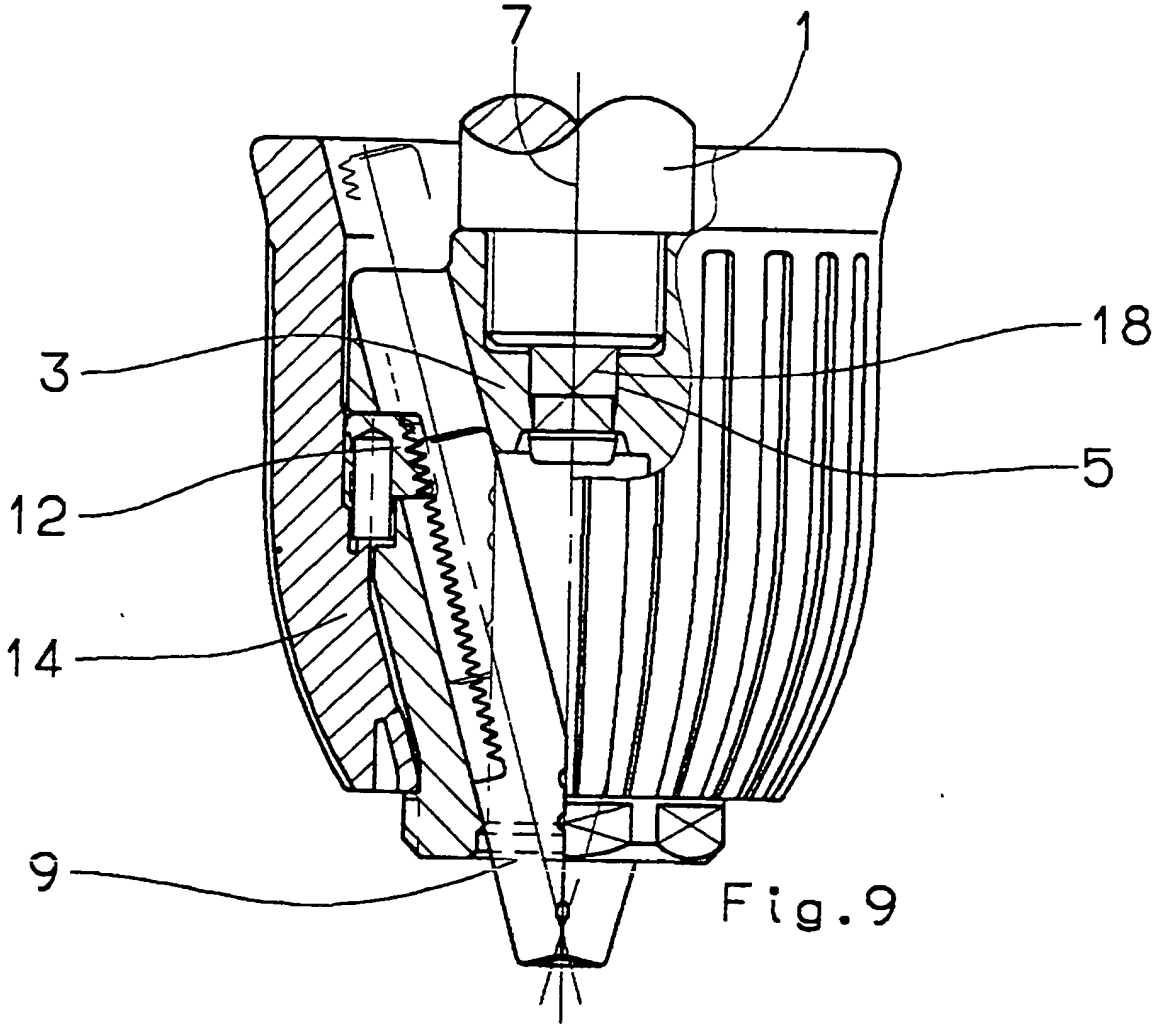


Fig.9

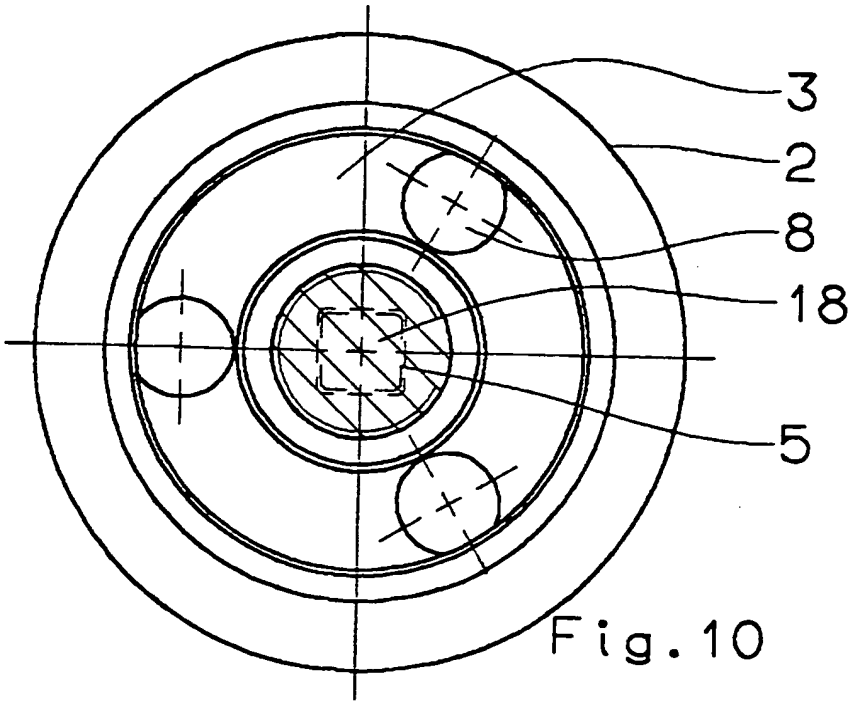


Fig.10

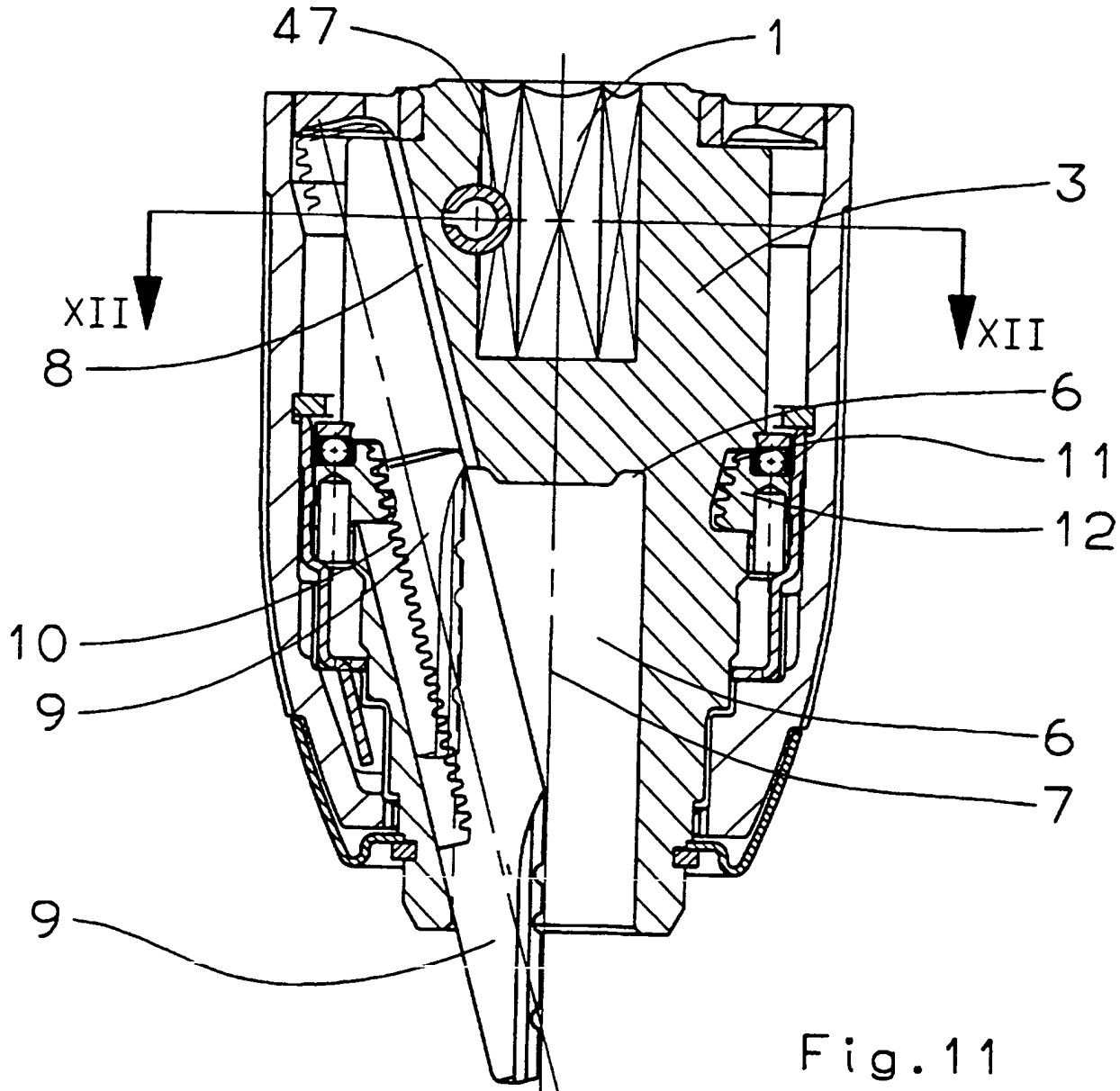


Fig.11

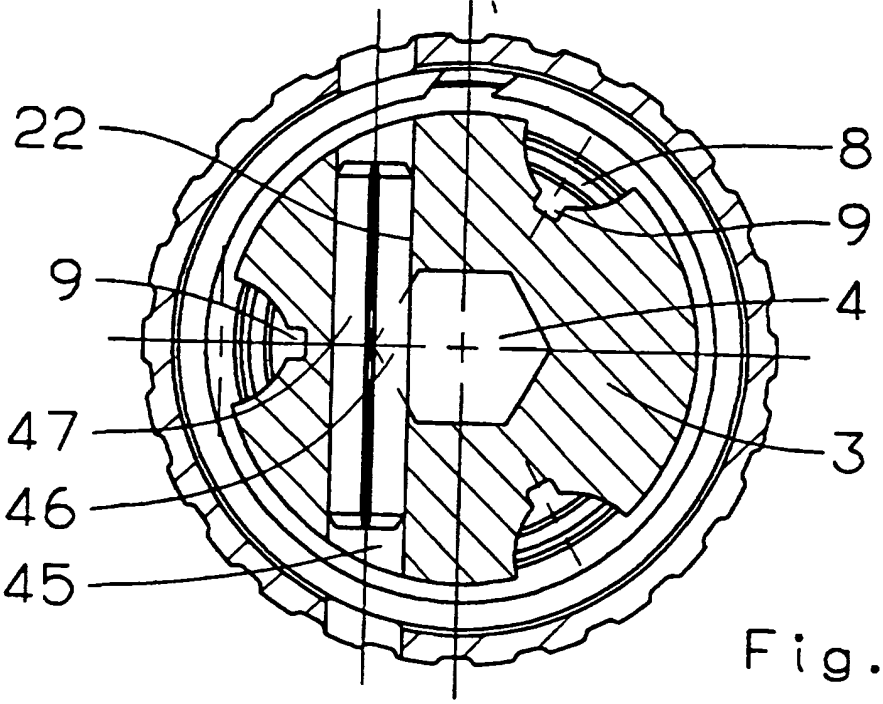


Fig.12

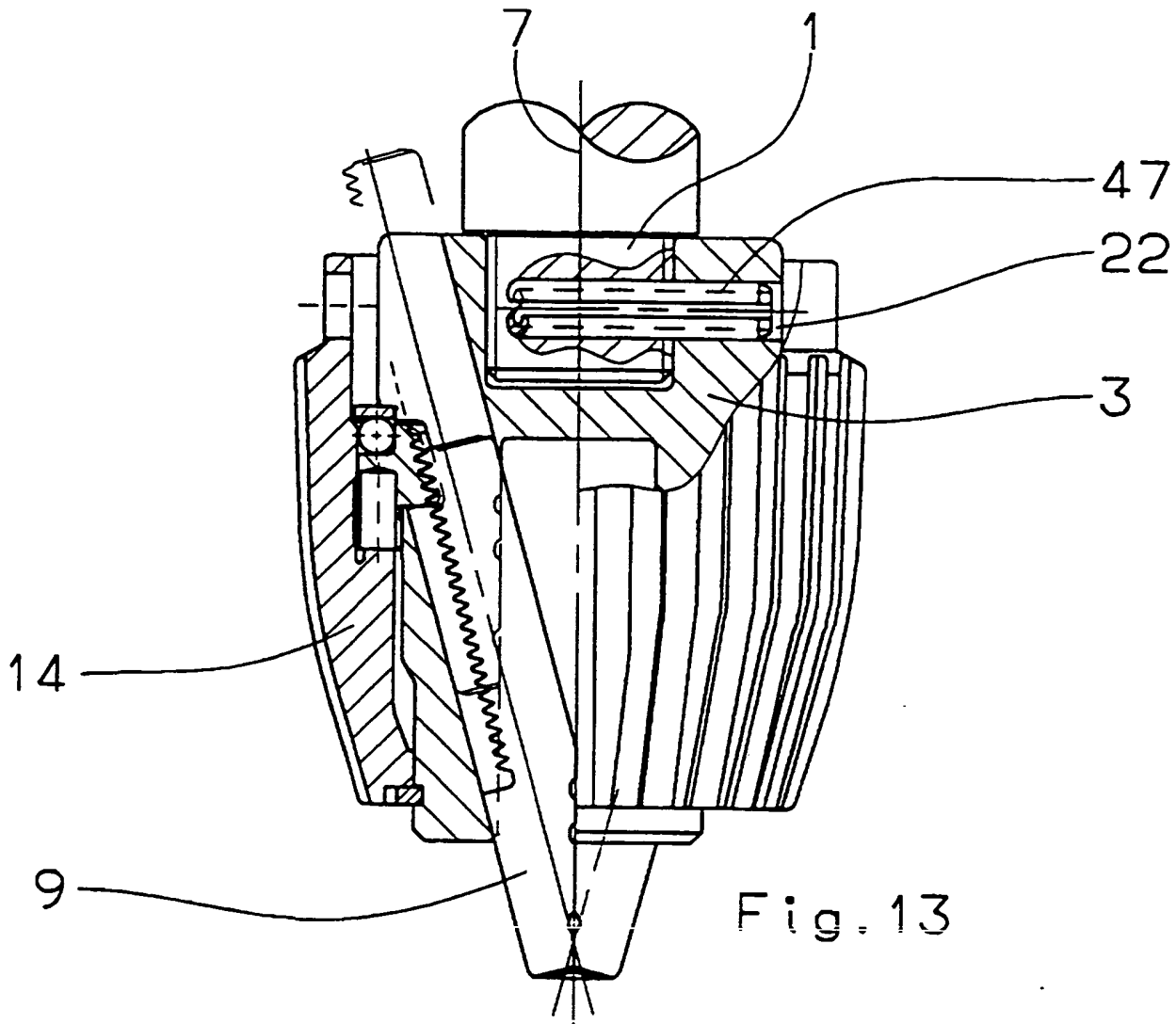


Fig. 13

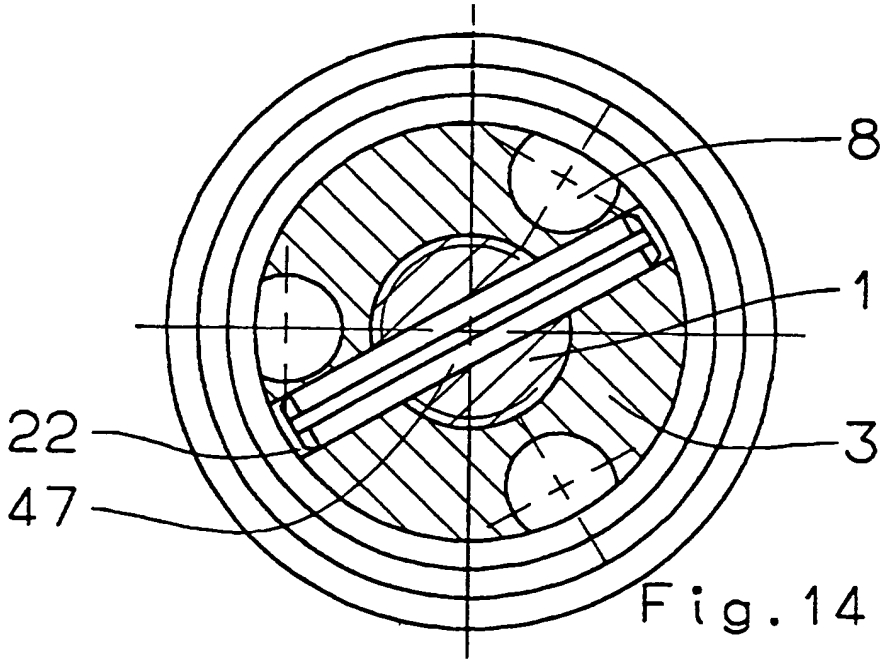


Fig. 14

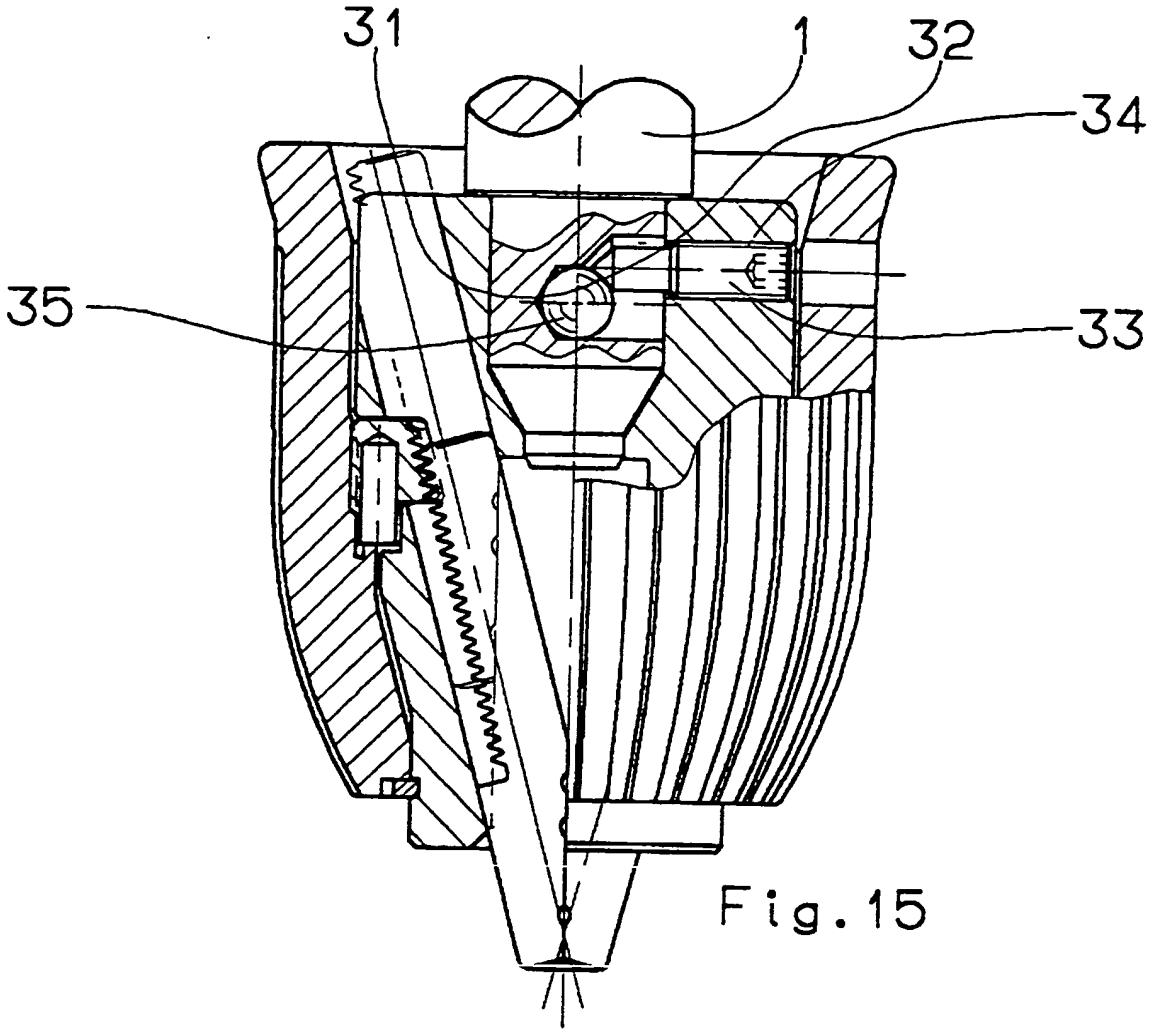


Fig.15

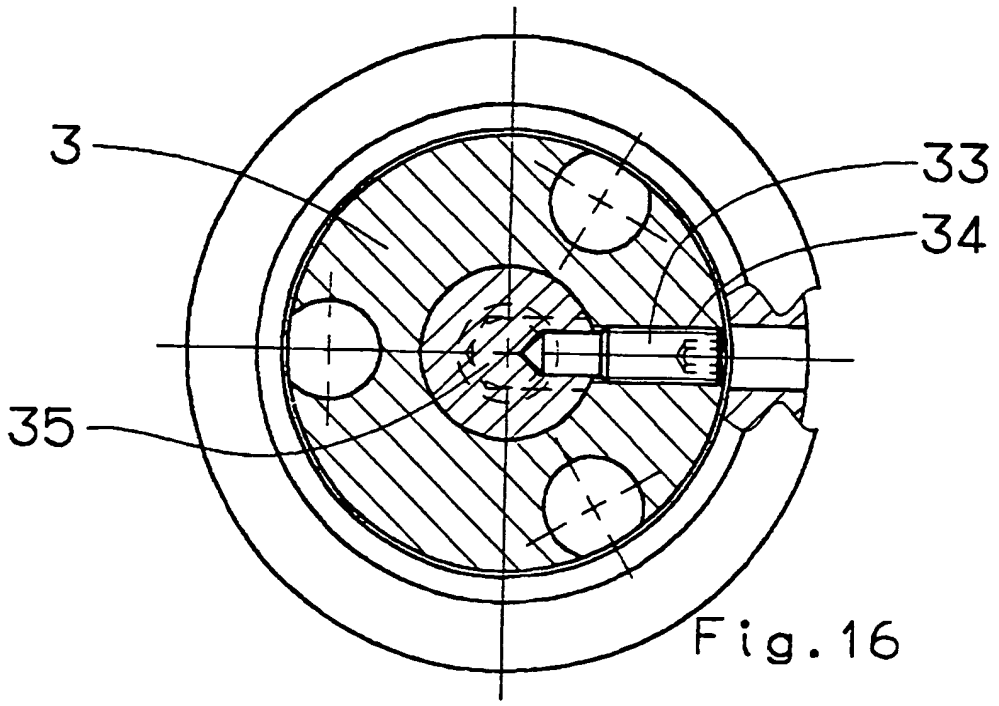
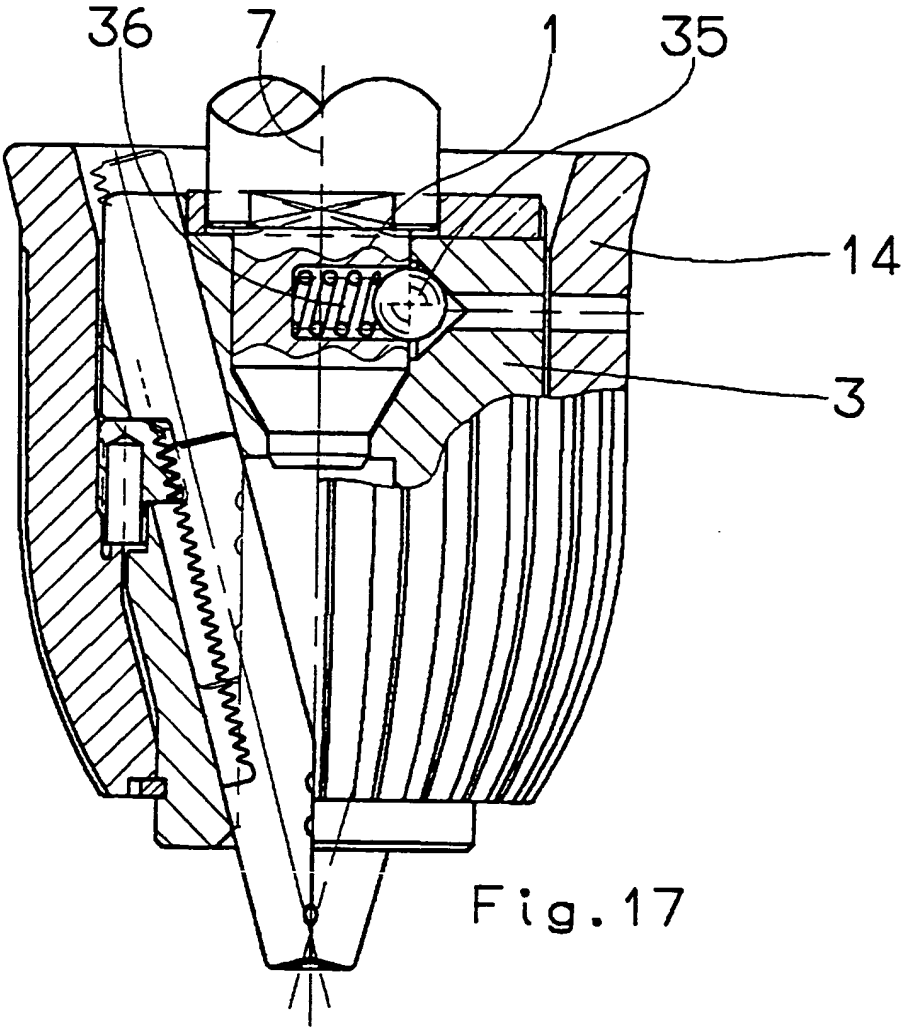


Fig.16



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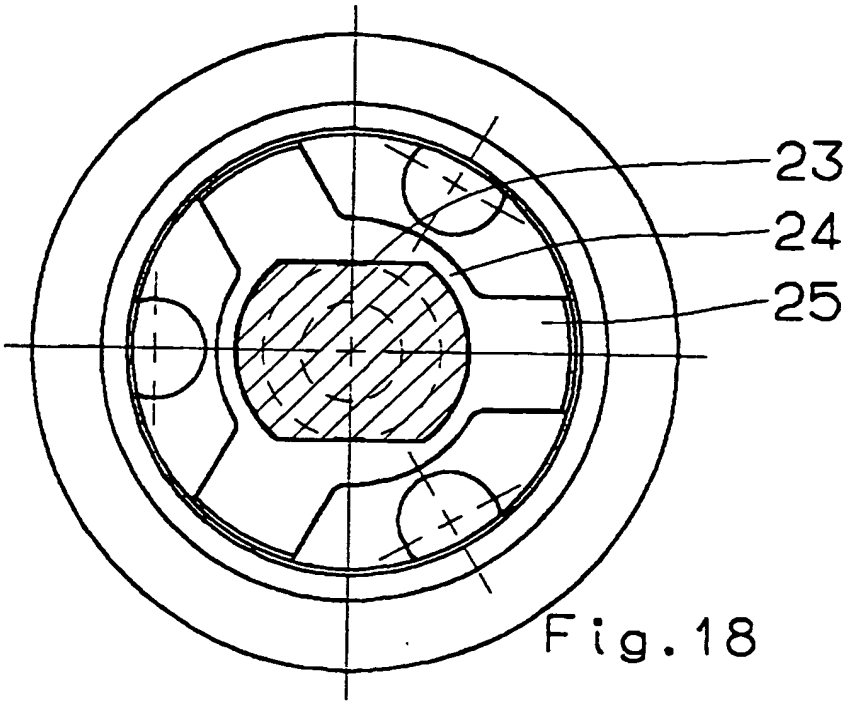


Fig.18

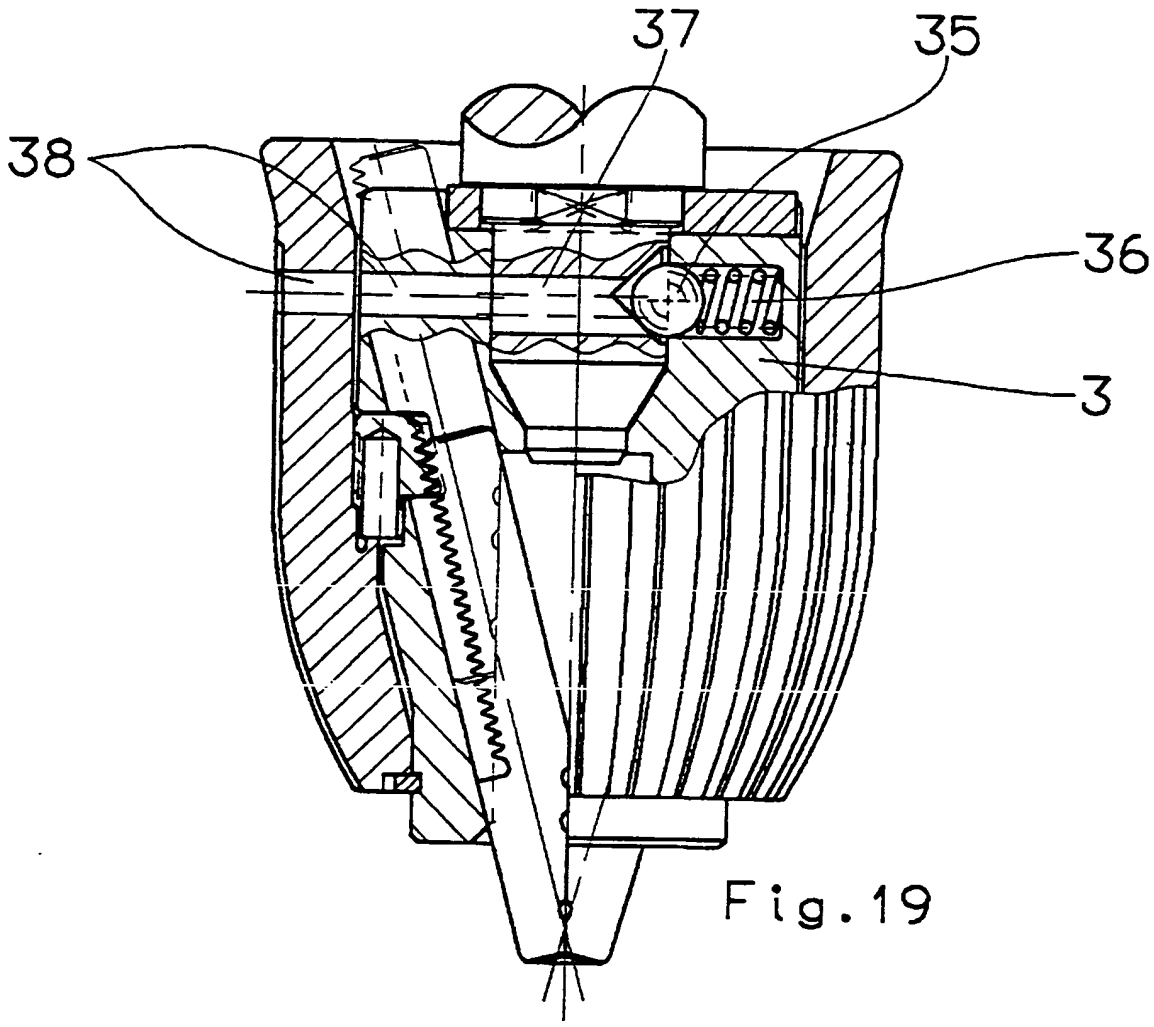


Fig.19

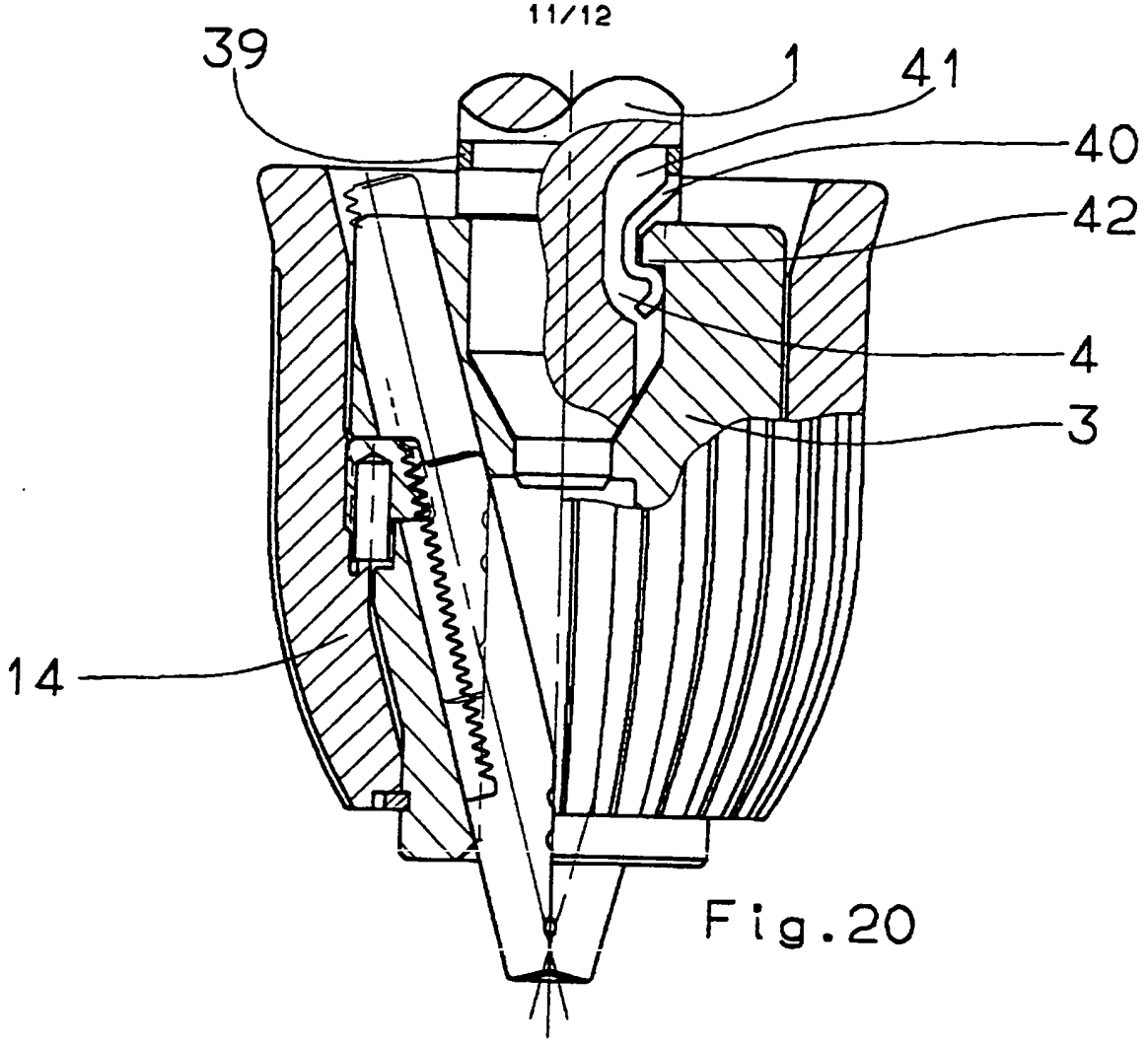
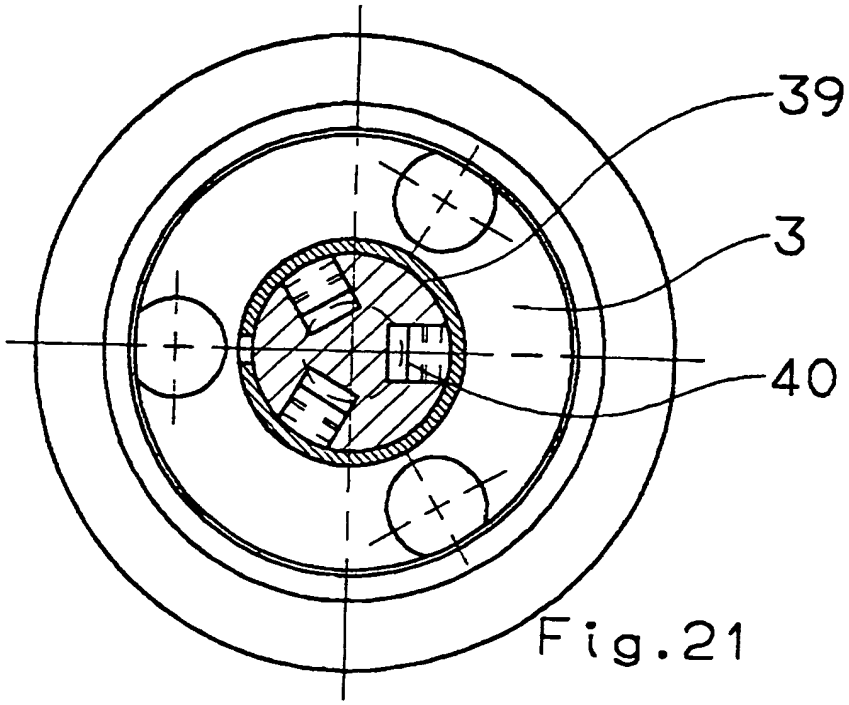


Fig.20



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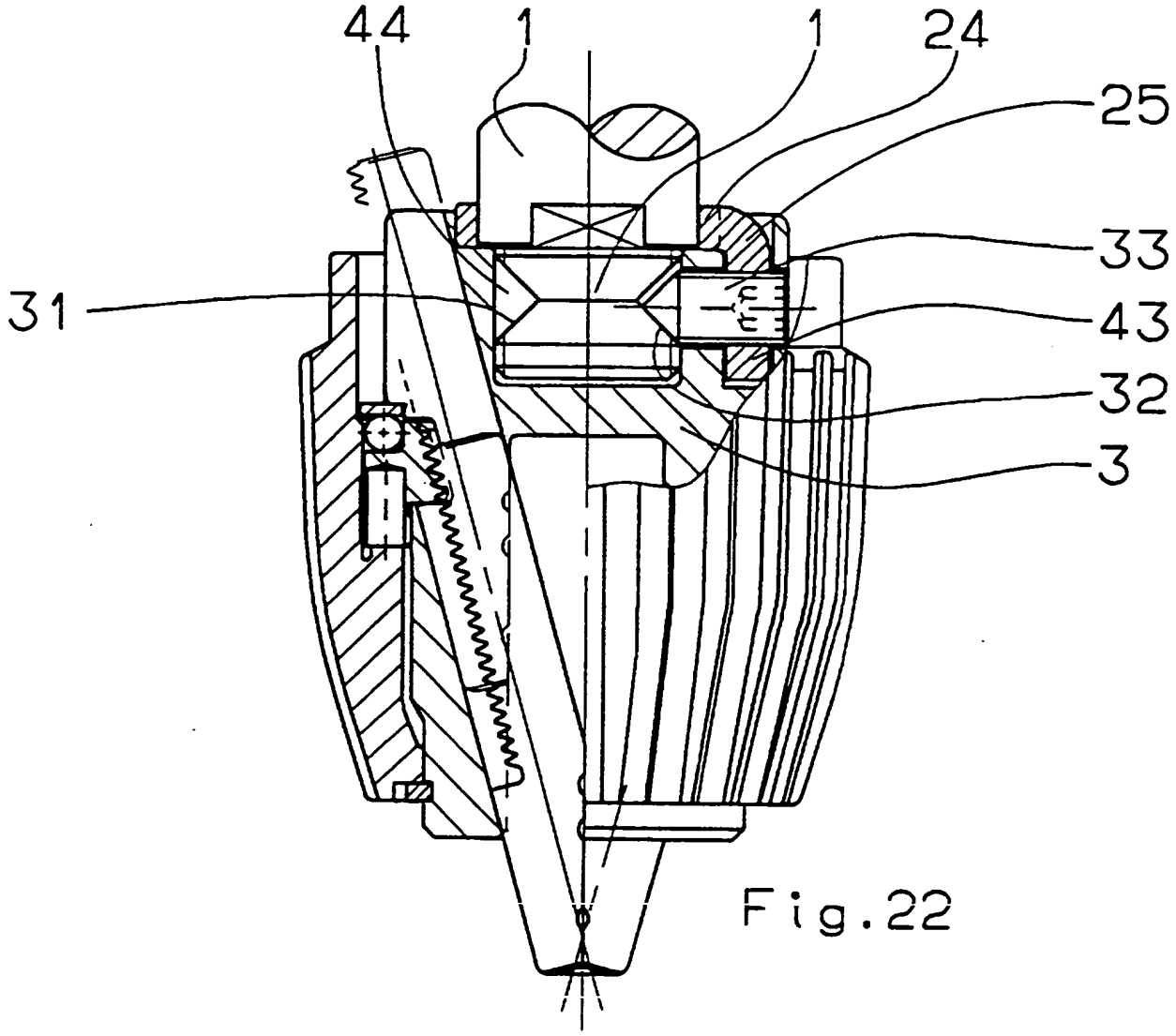

Fig.22

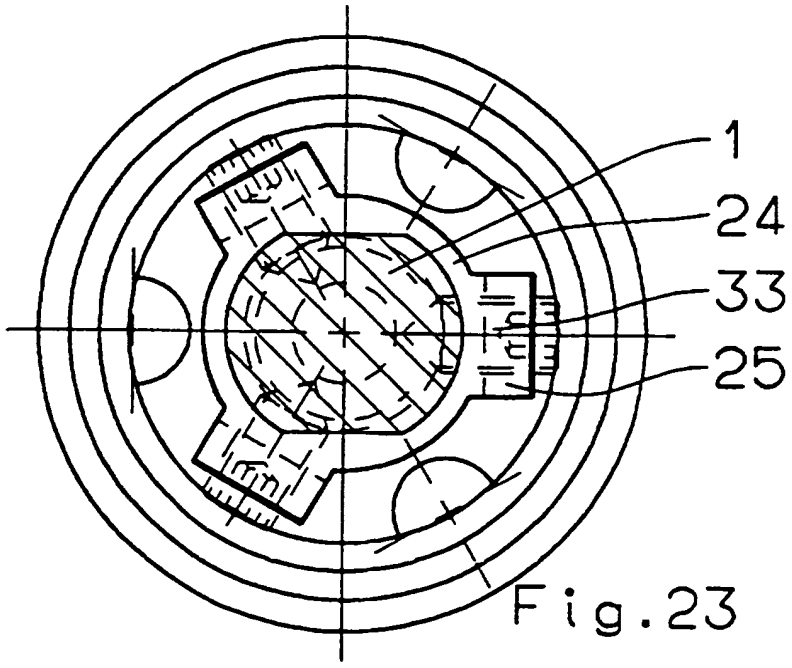

Fig.23

DRILLING APPARATUS

The invention concerns a drilling apparatus comprising a drilling machine having a spindle, and a drilling chuck with a chuck body in which a spindle receiving means is provided at its end towards the spindle and a tool receiving means is provided at the opposite end.

Drilling apparatuses of that kind are known from a practical context, wherein the coupling of the drilling machine and the drilling chuck is generally effected by way of a screwthreaded connection wherein a male screwthread is provided on the spindle and a female screwthread is provided in the spindle receiving means. That screwthread connection performs the double function of securing the axis position of the chuck body and thus the drilling chuck with respect to the drilling machine and at the same time forming a non-rotatable connection, by way of which the torque produced by the drilling machine can be transmitted. If however the drilling machine is designed for clockwise/counterclockwise operation, the problem which arises is that, in the event of a high level of drilling resistance in the direction of rotation corresponding to release of the drilling chuck, additional securing means are necessary to prevent separation of the coupling between the spindle and the drilling chuck.

An object of the present invention is further to improve the coupling between the drilling chuck and the spindle of the drilling machine.

In aspect, the invention provides drilling apparatus of the kind set forth in the opening part of this specification, in which the spindle is secured in its axial position with respect to the chuck body by a securing portion and that for the transmission of torque between the drilling chuck and the spindle the latter has a non-rotationally symmetrical portion which is non-rotatably coupled to a rotational receiving means provided on the chuck body.

The invention affords the advantage that the function of axially securing the position of the drilling chuck and rotational entrainment thereof are separated and transmission of the torque in drilling operation cannot have the result that the coupling between the drilling chuck and the spindle is released or the drilling chuck is displaced in the axial direction with respect to the spindle.

A particularly preferred embodiment of the invention is characterised in that provided in the chuck body is a passage or through opening which connects the spindle

receiving means and the tool receiving means and provided on the spindle is a spindle trunnion end portion which projects through the through opening and to which a securing ring is fixed as the securing portion, the securing ring bearing against the bottom of the tool receiving means. In this embodiment the spindle which is made from steel affords a rearward axial abutment for the drilling tool which is thereby also fixed in respect of its axial position and cannot wear or ruin the securing portion by a creep or impact-type effect.

In accordance with an alternative embodiment it is possible for the securing ring to be held in a groove which is formed in the spindle trunnion end portion and which extends in the peripheral direction. This embodiment affords cost advantages, more specifically both in regard to the use of material and also in terms of manufacture. Only very little space is taken up in the axial direction so that the trunnion end portion and the spindle can be short, which affords the possibility that the spindle can be provided with a screwthread in its rotationally symmetrical portions and, besides the drilling chuck which forms part of the invention, conventional drilling chucks can also be coupled to the drilling machine.

It is desirable if the securing ring is resilient in the axial direction as the resilient properties thereof provide for centering of the chuck body, even if the spindle trunnion end portion is not held in a snug or press fit in the through bore, which however is naturally equally possible. The resilient properties further ensure that the end of the spindle, at the transition to the spindle trunnion end portion, always bears under stress against the bottom of the spindle receiving means.

For the purposes of releasing the connection between the spindle and the drilling chuck, provided on the spindle trunnion end portion is at least groove which extends in the axial direction and which extends from the edge to the annular groove and into which a pin can be introduced for the purposes of spreading the securing ring open.

The securing ring can be fixed on the spindle trunnion end portion by way of a screwthreaded connection, for which purpose it is provided that the securing ring has a female screwthread co-operating with a male screwthread on the spindle trunnion end portion. In that respect, it is to be noted that no torque transmission is effected with that screwthreaded connection and the only aim in respect thereof is to provide for axially

securing the appropriate position in regard to the coupling between the drilling chuck and the spindle.

A further embodiment of the invention is characterised in that the spindle trunnion end portion which projects through the through opening is provided on the spindle and, to form a snap-engagement connection, a mushroom-shaped end is provided as the securing portion on the spindle trunnion end portion, and that the through opening is constricted by an annular shoulder or collar. This embodiment avoids the use of a separate securing portion or member which has to be placed on the spindle trunnion end portion only after the spindle trunnion end portion has been fitted through the through opening; on the contrary, a simple push-in operation is sufficient to make an axially firm coupling between the drilling chuck and the spindle.

In accordance with the invention it is further possible for a screw which bears with its screw head against the bottom of the tool receiving means to be screwed as the securing portion to the spindle trunnion end portion.

If the spindle has a first taper surface which extends inclinedly towards the edge and which is engaged by a second taper surface associated with the chuck body, then the taper surfaces, bearing against each other, which correspond to the non-rotationally symmetrical portion of the spindle and the rotational receiving means of the chuck body, provide an axial securing effect, the strength of which can be adjusted by way of mutual displacement of the taper surfaces, for which purpose axial play is available for radially displacing the taper surface with respect to the other taper surface and for holding the spindle in a condition of plane contact against the chuck body.

In regard to simplicity of structure, it is preferable if the second taper surface is formed on a securing pin which projects through a radial bore leading in the chuck body to the spindle receiving means.

To provide a secure, durable connection, it is then possible for the securing pin to be radially fixed in the bore by a screwthreaded connection.

In accordance with an alternative embodiment, it is provided that of the taper surfaces is formed by a radially displaceable ball.

The extent of the radial displacement of the ball and therewith the holding force can be adjusted if the ball is urged under the force of a spring in the direction of the other

taper surface. Furthermore the spring force provides for uniform good planar contact of the spindle against the chuck body.

To release the connection between the spindle and the chuck body, provided in the spindle is a radially extending slot which leads to the first taper surface and which is aligned with holes in the adjusting sleeve portion and the chuck body.

A further alternative for fixing the spindle is characterised in that fixed to the spindle is a ring with retaining or detent projections which are radially displaceable in projection receiving means provided in the spindle, the retaining or detent projections engaging behind retainer or detent limbs formed on the chuck body.

To secure good planar or surface contact of the spindle, it is provided that the retaining projections bear with a prestressing force against the retaining limbs.

A spindle which is distinguished by virtue of the simplicity of its configuration, with non-rotationally symmetrical portion, is afforded by at least planar surface being provided on the spindle. That planar surface and the planar surface corresponding thereto in the spindle receiving means are simple to produce and thus ensure a better accuracy of fit than when using cross-sectional profiles of a more complicated shape on the spindle and the spindle receiving means. If the spindle also has a screwthread, it is equally possible for conventional drilling chucks to be fixed with a screwthreaded receiving means to the spindle.

In order to achieve a lower level of loading in respect of the spindle receiving means in the transmission of torque, non-rotatably fixed on the planar surface of the spindle as a coupling member is a wing disc whose wings are held non-rotatably in the rotational receiving means. The spindle can also lie in its condition of planar contact on the wing disc. In order to achieve better distribution of the loading involved both in respect of the torque concerned and also in the axial direction for example in the hammer drilling mode of operation, the wing disc has a plurality of uniformly peripherally distributed wings. Formed on the wings is a plate which faces in the axial direction and in which the securing pin is held, the securing pin engaging into an annular groove in the spindle and thus forming an axial securing means. To form the taper surfaces, the groove has inclined side walls and the pin has a conical tip.

For the purposes of axially connecting the spindle and the chuck body, it is also possible for a radially extending pin passage to be formed in the spindle receiving means in

the chuck body, to receive a securing pin member which is to be inserted into an opening in the spindle. It is preferred in that arrangement for the opening in the spindle to extend through the axis of the spindle and for the securing pin member to engage with its edges into the rotational receiving means. In that way, the securing pin member provides both for an axial connection and also a rotational connection, without any threat of those connections coming loose or being released in the course of a drilling operation.

Alternatively it is possible for the connection between the drilling chuck and the spindle to be so provided that the spindle receiving means is of a non-round, preferably a polygonal cross-section, and the spindle is of a cross-sectional configuration corresponding thereto, or the spindle trunnion end portion and the through opening are of a mutually matching angular cross-sectional shape or the spindle trunnion end portion is shaped in the manner of a torx male member and the through opening is shaped in the manner of a torx socket.

The advantages achieved with the invention, in terms of separation of the functions of axially securing the appropriate position and the transmission of torque, are particularly pronounced if the chuck body comprises a fibre-reinforced plastics material in which a reliable screwthreaded connection between the spindle and the spindle receiving means can be achieved only at high cost because the individual screwthread flights are more susceptible to damage than in the case of comparable chuck bodies consisting of steel.

The invention will now be described by way of example only with reference to accompanying diagrammatic drawings, in which:

Figure 1 is a side view, partly in section, of a key-less drilling chuck;

Figure 2 is a plan view of the drilling chuck shown in Figure 1;

Figure 3 is a view corresponding in Figure 1 of a drilling chuck with the securing ring of a resilient nature;

Figure 4 shows the detail IV from Figure 3;

Figure 5 is a view corresponding to Figure 1 of a drilling chuck with a wing disc secured to the flat face of the spindle;

Figure 6 is a plan view of the drilling chuck shown in Figure 5;

Figure 7 is a view corresponding to Figure 1 of a drilling chuck with the snap-engagement connection between the spindle trunnion end portion and the chuck body and a torx connection;

Figure 8 is a plan view of the drilling chuck shown in Figure 7;

Figure 9 is a view corresponding to Figure 1 of a drilling chuck with a square through opening and a spindle trunnion end portion which is matched thereto;

Figure 10 is a plan view of the drilling chuck shown in Figure 9;

Figure 11 is a view in longitudinal section through a drilling chuck with a polygonal spindle receiving means and a securing pin member;

Figure 12 is a view in section taken along line XII-XII in Figure 11;

Figure 13 is a view corresponding to Figure 1 with a centrally inserted securing pin member;

Figure 14 is a plan view of the drilling chuck shown in Figure 13;

Figure 15 is a view corresponding to Figure 1 with axial securing of the spindle and the drilling chuck, which is implemented by way of two taper surfaces;

Figure 16 is a plan view of the drilling chuck shown in Figure 15;

Figure 17 is a view corresponding to Figure 1 with a spring-loaded ball arranged in the spindle;

Figure 18 is a plan view of the drilling chuck shown in Figure 17;

Figure 19 is a view corresponding to Figure 1 with a spring-loaded ball arranged in the chuck body;

Figure 20 is a view corresponding to Figure 1 with a ring fixed on the spindle, with retaining projections;

Figure 21 is a plan view of the drilling chuck shown in Figure 20;

Figure 22 is a view corresponding to Figure 1 with a wing disc having axially projecting plates; and

Figure 23 is a plan view of the drilling chuck shown in Figure 22.

The drilling apparatus shown in the drawings comprises a drilling machine of which however only the spindle 1 which is relevant for describing the invention is illustrated, and a drilling chuck 2. The drilling chuck 2 shown in Figure 1 has a chuck body 3, at whose end that is towards the spindle 1 there is provided a spindle receiving means 4 which communicates by way of a passage or through opening 5 with a tool

receiving means 6 disposed at the opposite end. Furthermore, provided in the chuck body 3 are guide receiving means 8 which are oriented inclinedly with respect to the axis 7 of the chuck and which are arranged in a uniformly peripherally distributed array and in which clamping jaws 9 are longitudinally displaceably guided. On the radially outwardly facing side, the clamping jaws 9 have a row of teeth 10 which is in engagement with the female screwthread 11 of a screwthreaded ring 12. The ring 12 is arranged in a peripherally extending groove 13 in the chuck body 3 and is supported in the axially rearward direction on the chuck body 3 by way of a bearing and a thrust bearing ring. An adjusting sleeve portion 14 is non-rotatably connected to the screwthreaded ring 12 so that, upon rotational movement of the adjusting sleeve portion 14 which is to be gripped by the user, the screwthreaded ring 12 is also turned and thereby the clamping jaws 9 are displaced in their guide receiving means 8.

In the case of the drilling apparatuses shown in the drawings, the coupling between the spindle 1 and the drilling chuck 2 is such that the function of axially securing the position of the chuck body 3 with respect to the spindle 1 and the torque-transmitting function are not effected by a unitary arrangement, as occurs for example when employing a screwthreaded connection with a screwthreaded spindle which is secured in the spindle receiving means 4 having a female screwthread. On the contrary, the spindle 1 is secured in its axial position with respect to the chuck body 3, by a securing portion 15. For the purposes of transmission of torque between the drilling chuck 2 and the spindle 1, the latter has a non-rotationally symmetrically portion 16 which is non-rotatably coupled to a rotational receiving means 22 formed on the chuck body 3.

In the embodiments illustrated in Figures 1 and 2 the securing portion 15 is formed by a securing ring 17 which is supported against the bottom of the tool receiving means 6 and is also fixed to a spindle trunnion end portion 18 which is arranged at the free end of the spindle 1 and which projects through the through opening 5. The securing ring 17 is fixed on the spindle trunnion end portion 18 by the securing 17 being introduced into a peripherally extending annular groove 19 which is formed on the spindle trunnion end portion 18. The securing ring 17 has spring properties which are operative in the axial direction, which, as shown in Figure 4, is embodied by the securing ring 17 not being flat but bearing at an angle against the surfaces at the bottom of the tool receiving means 6 and the wall of the groove, so that an attempt to separate the spindle 1 with the spindle

trunnion end portion 18 from the drilling chuck 2 has the result that the securing ring 17 is deformed and when that happens a return force is generated. Due to the resilient properties, there is also a biasing or prestressing effect which holds the spindle 1 in a condition of planar contact in the spindle receiving means 4 and against the chuck body 3 respectively. Provided on the spindle trunnion end portion 18 is an axially extending groove 30 which extends from the edge to the annular groove 19. The pins of a sleeve member which is to be introduced into the tool receiving means 6 can be inserted into the groove 30, the pins serving to spread open the securing ring 17 so that the chuck body 3 can be removed from the spindle 1 again.

In accordance with an embodiment which is not shown however it is equally possible, instead of a securing ring 17, to provide a nut which is screwed on to a male screwthread on the spindle trunnion end portion 18.

A further embodiment is shown in Figures 7 to 10 in which the spindle trunnion end portion 18 has a securing portion 15 in the form of a mushroom head-shaped end 20 which co-operates with an annular shoulder or collar 21 that constricts the through opening 5, when the spindle trunnion end portion 18 is pressed axially from the rear forwardly through the through opening 5 and, after passing the annular collar 21, the mushroom head-shaped end 20 of the spindle trunnion end portion 18 is secured in position by the annular collar 21.

In the drilling apparatuses shown in Figures 15 to 19 the spindle 1 has a first taper surface 31 which extends inclinedly towards the edge and which is engaged by a second taper surface 32 associated with the chuck body 3, wherein axial play is available in order to be able radially to displace the taper surface 31 with respect to the other taper surface 32 and in that situation to be able also axially to displace them in accordance with the inclination of the taper surfaces 31, 32 and thus to hold the spindle 1 in a fixed condition of planar contact against the chuck body 3.

In Figures 15 and 16 the second taper surface 32 is formed on a securing pin 33 which projects through a radial bore leading in the chuck body 3 to the spindle receiving means 4. The securing pin 33 is radially fixed in the bore by a screwthreaded connection 34.

The drawings show that of the taper surfaces 31, 32 is formed by a radially displaceable ball 35, while as shown in Figures 15 to 18 the first taper surface 31 which is

associated with the spindle 1 is provided on the ball 35 which itself is held in a cage to prevent it from being lost. In Figure 19 the ball 35 is associated with the chuck body 3.

The ball 36 is urged under the force of a spring 36 in the direction of the other taper surface 31, 32. A bore also leads to the ball 35, through which bore it is possible to insert a pin to release the ball 35 from the other taper surface 31, 32 against the force of the spring 36 and to be able to withdraw the drilling chuck 2 from the spindle 1 again. In that respect, in the drilling apparatus shown in Figure 19, provided in the spindle 1 is a radially extending slot 37 which leads to the first taper surface 31 and which aligns with holes 38 in the adjusting sleeve portion 14 and the chuck body 3 so that the spindle 1, with the inserted pin, can be axially displaced until the ball 35 bears against the wall of the spindle receiving means 4.

In Figures 20 and 21, fixed to the spindle 1 is a ring 39 having retaining or detent projections 40 which are radially displaceable in projection receiving means 41 provided in the spindle 1, with the retaining projections 40 engaging behind retaining or detent limbs 42 provided on the chuck body 3, the retaining projections 40 bearing in a prestressed condition against the retaining limbs 42.

The above-described drilling apparatuses are distinguished in that coupling between the spindle 1 and the drilling chuck 2 is possible by virtue of simple push-in operations in which the taper surfaces 31, 32 which come to bear against each other guarantee the axial securing effect; it is thus possible to implement a change in the drilling chuck 2 in an extremely simple and rapid fashion.

Torque is transmitted by virtue of the fact that, as shown in Figure 2, the spindle 1 has two flat or planar surfaces 23 which result in a non-rotatable connection between the spindle 1 and the chuck body 3 when the spindle 1 is introduced into the correspondingly shaped spindle receiving means 4. In that case, the spindle 1 can nonetheless still have a male screwthread so that coupling of conventional drilling chucks 2 with a screwthreaded receiving means to the drilling machine of the drilling apparatus is also possible.

It is also possible for the extent of the flat or planar surfaces 23 on the spindle 1 to be limited in the axial direction and for a wing disc 24 then to be non-rotatably fixed on the surfaces 23; the disc 24 has three radially outwardly extending wings 25 arranged in a uniformly peripherally distributed array, which are non-rotatably held in wing receiving

means or recesses 26 in the chuck body 3. Figure 22 shows an embodiment in which plates 43 which face in the axial direction are provided on the wings 25 and are used for axial securing purposes and in which there is held the securing pin member 33 which engages into an annular groove 44 in the spindle. The side walls of the annular groove 44 are inclined to form the first taper surface 31.

In Figures 11 to 14, for axially securing the spindle 1 in the spindle receiving means 4, the chuck body 3 has a radially extending pin passage 45 for receiving a securing pin member 47 which is to be inserted into an opening 46 in the spindle. In Figures 11 and 12, the securing pin member 47 engages the outside surface of the spindle 1. In comparison in Figures 13 and 14, the opening 47 in the spindle extends through the axis 7 of the spindle, wherein the securing pin member 47 engages with its edges into the rotational receiving means 22 and therefore serves at the same time for torque transmission purposes.

Figures 7 to 10 show embodiments in which the spindle trunnion end portion 18 and the through opening 5, or in Figures 11 and 12, the spindle and the spindle receiving means, are of a mutually matching cross-sectional shape, more specifically in Figures 9 and 10 an angular cross-sectional shape of square cross-section. In Figures 7 and 8 the spindle trunnion end portion 18 is shaped in the manner of a torx male portion 27 and the through opening 5 is shaped n the manner of a torx socket 28.

The advantages of the drilling apparatus according to the invention are enjoyed both when using the tried-and-tested material steel for the chuck body 3 and the wing disc 25, and also when using a fibre-reinforced plastics material, in which case the fact that the loadings on the coupling between the spindle 1 and the chuck body 3 can be separated for the axial securing effect and for torque transmission purposes additionally has an advantageous effect. Drilling chucks 2 of fibre-reinforced plastics material are described in German patent application No. 198 00 999.2, to the disclosure of which attention is here expressly directed for the avoidance of repetition and to which reference is made as part of this description. A highly suitable fibre-reinforced plastics material for forming the chuck body 2 is a polyamide which is reinforced by glass fibres and carbon fibres. In regard to the material properties of the polyamide, a glass fibre content of 20% and a carbon fibre content of 10% have proven to be particularly desirable, depending on the demands made on the material and the loadings to be expected. However the glass fibre

content can also be between 5% and 35%, in particular between 10% and 25%, while the carbon fibre content can be between 5% and 25%, in particular between 5% and 15%.

It will be appreciated that the foregoing is merely exemplary of drilling apparatus in accordance with the invention and that modifications can readily be made thereto without departing from the true scope of the invention as set out in the appended claims.

CLAIMS:

1. A drilling apparatus comprising a drilling machine having a spindle, and a drilling chuck with a chuck body in which a spindle receiving means is provided at its end towards the spindle and a tool receiving means is provided at the opposite end, wherein the spindle is secured in its axial position with respect to the chuck body by a securing portion and, for the transmission of torque between the drilling chuck and the spindle, the spindle has a non-rotationally symmetrical portion which is non-rotatably coupled to a rotational receiving means provided on the chuck body.

2. A drilling apparatus according to Claim 1, wherein provided in the chuck body is a through opening which connects the spindle receiving means and the tool receiving means, and wherein provided on the spindle is a spindle trunnion end portion which projects through the through opening and to which a securing ring is fixed as the securing portion, the securing ring bearing against the bottom of the tool receiving means.

3. A drilling apparatus according to Claim 2, wherein the securing ring is held in an annular groove which is formed on the spindle trunnion end portion and which extends in the peripheral direction.

4. A drilling apparatus according to Claim 2 or Claim 3, wherein the securing ring is resilient in the axial direction.

5. A drilling apparatus according to Claim 3 or Claim 4, wherein provided on the spindle trunnion end portion is at least groove which extends in the axial direction and which extends from the edge to the annular groove.

6. A drilling apparatus according to Claim 1, wherein a through opening which connects the spindle receiving means and the tool receiving means is provided in the chuck body and a spindle trunnion end portion which projects through the through opening is provided on the spindle, and wherein to form a snap-engagement connection, a mushroom head-shaped end is provided as the securing portion on the spindle trunnion end portion, the through opening being constricted by an annular collar.

7. A drilling apparatus according to Claim 2, wherein the securing ring has a female screwthread co-operating with a male screwthread on the spindle trunnion end portion.

8. A drilling apparatus according to Claim 2, wherein a screw which bears with its screw head against the bottom of the tool receiving means is screwed as the securing portion to the spindle trunnion end portion.

9. A drilling apparatus according to any one of Claims 1 to 8, wherein the spindle has a first taper surface which extends inclinedly towards the edge and which is engaged by a second taper surface associated with the chuck body.

10. A drilling apparatus according to Claim 9, wherein axial play is available for radially displacing the taper surface with respect to the other taper surface and for holding the spindle in a condition of planar contact against the chuck body,.

11. A drilling apparatus according to Claim 9 or Claim 10, wherein the second surface is formed on a securing pin which projects through a radial bore leading in the chuck body to the spindle receiving means.

12. A drilling apparatus according to Claim 11, wherein the securing pin is radially fixed in the bore by a screwthreaded connection.

13. A drilling apparatus according to any one of Claims 9 to 12, wherein of the taper surfaces is formed by a radially displaceable ball.

14. A drilling apparatus according to Claim 13, wherein the ball is urged under the force of a spring in the direction of the other taper surface.

15. A drilling apparatus according to Claim 13 or Claim 14, wherein provided in the spindle is a radially extending slot which leads to the first taper surface and which is aligned with holes in the adjusting sleeve portion and the chuck body.

16. A drilling apparatus according to any one of Claims 1 to 15, wherein fixed to the spindle is a ring with retaining projections which are radially displaceable in projection receiving means provided in the spindle, the retaining projections engaging behind retaining limbs formed on the chuck body.

17. A drilling apparatus according to Claim 16, wherein the retaining projections bear with a prestressing force against the retaining limbs.

18. A drilling apparatus according to any one of Claims 1 to 17, wherein at least planar surface is provided on the spindle.

19. A drilling apparatus according to Claim 18, wherein a wing disc is non-rotatably fixed on the planar surface of the spindle as a coupling member, the wings of the wing disc being held non-rotatably in the rotational receiving means.

20. A drilling apparatus according to Claim 19, wherein the wing disc has a plurality of wings which are uniformly distributed over the periphery thereof.

21 A drilling apparatus according to Claim 19 or Claim 20, wherein provided on the wing is a plate which faces in the axial direction and in which is held the securing pin which engages into an annular groove in the spindle.

22. A drilling apparatus according to Claim 21, wherein the annular groove has inclined side walls and the pin has a conical tip.

23. A drilling apparatus according to any one of Claims 1 to 22, wherein for the purposes of axially securing the spindle in the spindle receiving means, provided in the chuck body is a radially extending pin passage for receiving a securing pin member which is to be inserted into an opening in the spindle.

24. A drilling apparatus according to Claim 23, wherein the opening in the spindle extends through the axis of the spindle and that the securing pin member engages with its edges into the rotational receiving means.

25. A drilling apparatus according to any one of Claims 1 to 24, wherein the spindle re neans is of a non-round, preferably a polygonal cross-section, and the spindle is of a cross-sectional configuration corresponding thereto.

26. A drilling apparatus according to any one of Claims 2 to 25, wherein the spindle trunnion end portion and the through opening are of a mutually matching angular cross-sectional shape.

27. A drilling apparatus according to any one of Claims 2 to 26, wherein the spindle trunnion end portion is shaped in the manner of a torx male member and the through opening is shaped in the manner of a torx socket.

28. A drilling apparatus according to any one of Claims 1 to 27, wherein the spindle has a screwthread.

29. A drilling apparatus according to any one of Claims 1 to 28, wherein the chuck body comprises a fibre-reinforced plastics material.

30. A drilling apparatus substantially as herein described and as described with reference to the accompanying diagrammatic drawings.

Application No: GB 9900608.2
Claims searched: 1-30

Examiner: Dave Butters
Date of search: 29 March 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): B3B

Int Cl (Ed.6): B23B, B23Q

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2152408 A (ROHM)(see item 3 in the drawings)	1,25 at least
X	US 5342154 A (BOSCH)(see items 15 & 18 in the drawings)	1,9,10,25 at least
X	US 4968191 A (MILWAUKEE)(see items 26 & 29 in the drawings)	1,2,8,18, 25,26,28 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.